

Global patterns of carbon emissions

You will probably be familiar already with the general pattern of global carbon emissions. The highest polluters in terms of total carbon output are high- and middle-income countries with large populations, including China, the USA, India, Russia, Japan and Germany (Figure 2.10).

When comparing countries there are three important things to remember:

- Data showing **per capita carbon footprints** reveal a very different pattern. The highest figures belong to oil-rich Middle Eastern states including Qatar and Kuwait. The USA and EU countries have relatively high per capita carbon footprints but so too do many Caribbean countries where wood is burned widely. China has a relatively low per capita carbon footprint.

Keyword definition

Per capita carbon footprint

The amount of carbon dioxide emissions an average person in a country is responsible for as they go about their everyday life.

- Current data show the present-day **anthropogenic carbon flow** generated by different countries. However, data showing which countries are responsible for most of the **anthropogenic carbon stock** already in the atmosphere reveal a very different pattern; Germany, for example, may be to blame for around 6.9 per cent of all anthropogenic carbon emissions dating back to 1750 (according to the World Resources Institute). In 2015, Germany accounted for only 2.3 per cent of current carbon flow. Therefore, our perception of which countries should be held most to account for anthropogenic climate change may alter depending on whether we look at carbon stock or carbon flow data – or both.
- We need to think carefully about globalization and trade too. Some high-income countries claim to have reduced their carbon emissions in recent years. However, falling domestic emissions mask the fact that many developed countries now import much of their food and consumer goods from other countries since **deindustrialization** and globalization took place. Although they have reduced their own emissions, they have increased their overall carbon consumption through importing energy-intensive goods produced in emerging economies. Some people believe countries should be held accountable for the carbon emitted by goods they consume but which were made in other places. If we factor in global trade, then a very different pattern of responsibility for climate change emerges. Germany's annual share of global carbon emissions rises to almost 10 per cent, for instance.

Keyword definitions

Anthropogenic carbon flow The current amount of carbon emission released annually by a country (for example, due to fossil fuel burning and cement making) produced in each nation. The figure can be adjusted upwards to factor in the carbon equivalents of other greenhouse gas emissions (methane and nitrous oxide).

Anthropogenic carbon stock The total size of the store of anthropogenic carbon emissions released into the atmosphere since industrialization began around 1750.

Deindustrialization The loss of traditional manufacturing industries in some high-income countries due to their closure or relocation elsewhere. Since the 1960s, many industries have all but vanished from Europe and North America. Instead, they thrive in Asia, South America and, increasingly, Africa.

PPPPSS CONCEPTS

Think about how our perceptions of who is most to blame for anthropogenic carbon emissions varies according to which measurement is used. Factoring in global interactions with other places where commodities are manufactured may be the best way to reveal the true carbon footprint of high-income countries.

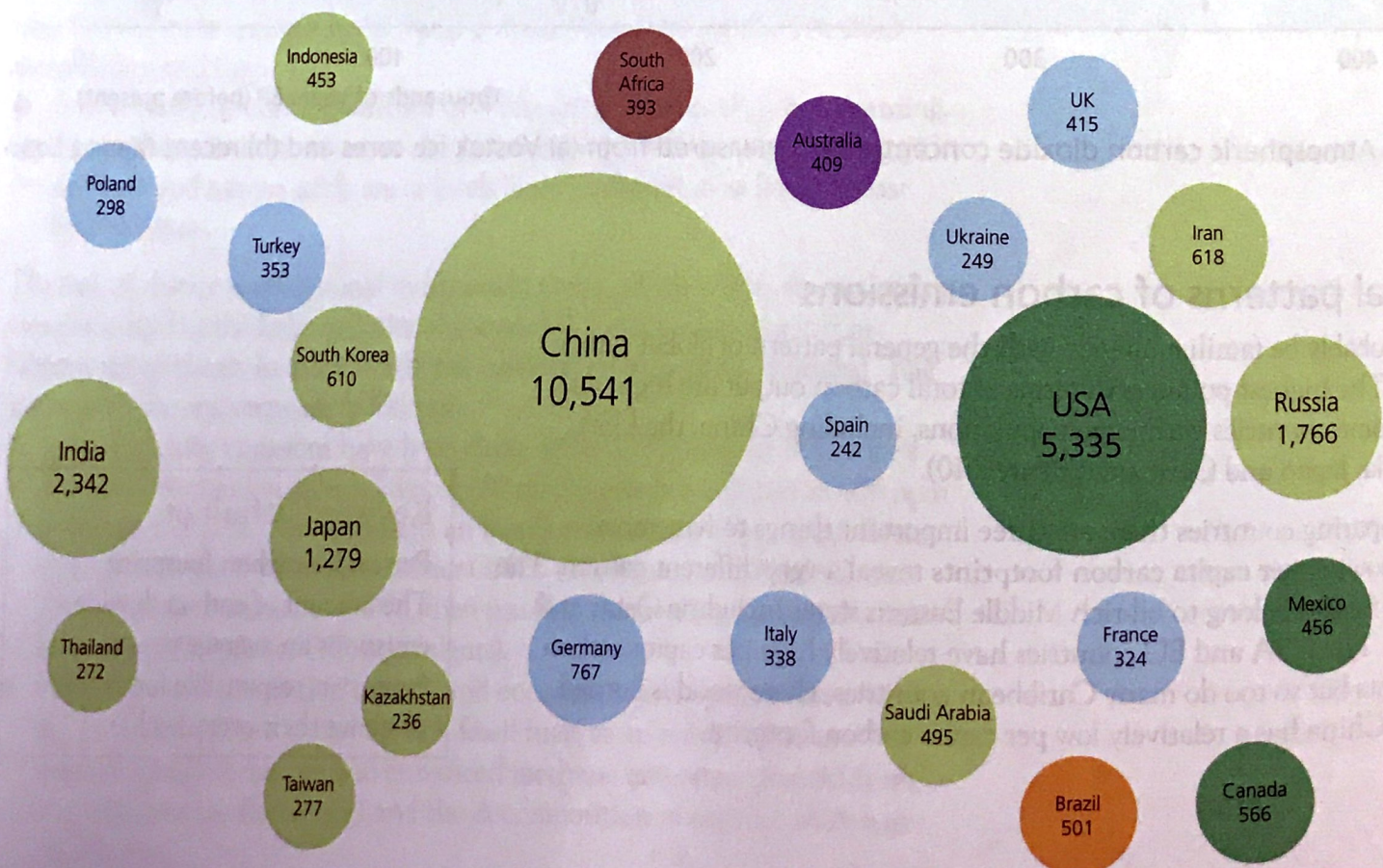


Figure 2.10 Global carbon emissions for selected countries, 2014 (million metric tonnes)

Table 2.3 analyses the role and actions of selected individual states and groups of countries in relation to global carbon and GHG emissions.

Table 2.3 The role and actions of states and groups of countries in relation to global emissions

Role and actions	
USA	<ul style="list-style-type: none"> ■ The USA is the world's second biggest emitter, generating just under one fifth of all anthropogenic GHGs. This is despite its population size being less than 5 per cent of the global total. ■ In recent years, its carbon emissions have fallen by around 10 per cent. The main reason for this is a shift from coal to gas burning within the USA's energy mix. A gas-fired plant produces half the emissions of a coal-fired one. ■ On a per capita basis, the USA still has a carbon footprint five times higher than China. Under the Obama administration, the USA began taking greater action to address its emissions. However, the Trump administration is more skeptical of the need for action.
China	<ul style="list-style-type: none"> ■ China became the world's largest carbon emitter in 2007 on account of widespread industrialization since the 1970s (see page 83). A massive programme of poverty alleviation (requiring more, not less, energy) remains the country's priority. ■ China now contributes around one quarter of world emissions while accounting for one fifth of world population. Its emissions rose by almost 10 per cent in 2011 alone, primarily due to higher coal consumption. ■ China's leaders want to reduce the rate at which their emissions rise and have made a (non-binding) pledge to reduce the carbon intensity of the country's growth by adopting more renewable energy into their mix. For instance, China spent US\$10 billion on wind turbines in 2010 – about half of all global spending. Such actions will not lead to a cut in total emissions but will curb the rate at which China's emissions grow.
India	<ul style="list-style-type: none"> ■ India is home to nearly one fifth of the world's population. Currently, it contributes more than 5 per cent of global CO₂ emissions.
Qatar	<ul style="list-style-type: none"> ■ The oil-rich desert state of Qatar has exceedingly high per capita emissions. The country's great oil wealth is used to fund high energy usage, including lavish use of air conditioning.
Japan and Germany	<ul style="list-style-type: none"> ■ Japan's emissions have increased by several per cent recently as a result of a substantial increase in the use of fossil fuels in power generation. This is part of a reaction against the use of nuclear power following the accident at Fukushima in 2011. Germany is also phasing out nuclear power but hopes to restrict emission rises by adopting renewable energy sources.
Low-income countries	<ul style="list-style-type: none"> ■ Many of the world's least developed countries (LDCs), such as Somalia, continue to make a negligible contribution to anthropogenic GHG emissions, although economic changes in some African countries, such as Nigeria and Kenya, mean that energy consumption there is rising. ■ People in some poor countries may have a high per capita carbon footprint because of their reliance on wood-burning stoves as a source of heat and energy for cooking.

Keyword definitions

Carbon intensity The amount of CO₂ emitted per unit of GDP. If a country's carbon emissions rise less slowly than its GDP is increasing, this suggests some action is being taken to reduce emissions at the same time as industrial output is increasing.

Renewable energy Wind, solar and tidal power sources that result from a flow of energy from the Sun.

■ The complexity of the dynamic climate system

This chapter has demonstrated that climate change science is far from simple. There is uncertainty over the operation of feedback loops. Nor can we predict with any certainty what kinds of economic and demographic changes will take place globally or in particular countries, as Unit 1 showed. As a result, climate

change presents us with a **wicked problem** which – because of its complexity – defies attempts to establish exactly what its effects would be. Unfortunately, this uncertainty is seized upon by climate change skeptics as a reason to avoid taking any action to reduce GHG emissions.

Other factors introduce greater complexity yet into climate change models. Natural climatic cycles like the **El Niño Southern Oscillation (ENSO)** and the North Atlantic Oscillation (NAO) are independent phenomena that operate naturally on shorter, decade-long timescales. They introduce year-to-year climatic variability into numerous different local contexts. Both phenomena can bring colder conditions temporarily to places that are predicted to get warmer on account of long-term climate change. This complicates our understanding of long-term climate change and can undermine public faith in IPCC expert predictions. People who lack deeper scientific understanding of the issues may – quite understandably but erroneously – view one unusually cold winter as ‘irrefutable proof’ that the planet cannot be warming up.

Figure 2.11 provides a useful summary of some of the many different influences on climate change processes and the high levels of complexity and uncertainty that affect future predictions of climatic change.

Keyword definitions

Wicked problem A challenge that cannot be dealt with easily owing to its scale and/or complexity. Wicked problems arise from the interactions of many different places, people, things, ideas and perspectives within complex and interconnected systems.

El Niño Southern Oscillation (ENSO) A sustained sea surface temperature anomaly across the central tropical Pacific Ocean. It brings a change in weather conditions that can last from two to seven years. Along with La Niña events, El Niño events are part of a short-term climate cycle that brings variations in climate but only for a few years.

PPPPSS CONCEPTS

Think about the complexity of the climate system. Why might different people living in different places have varying perspectives on whether or not climate change is a ‘fact’?

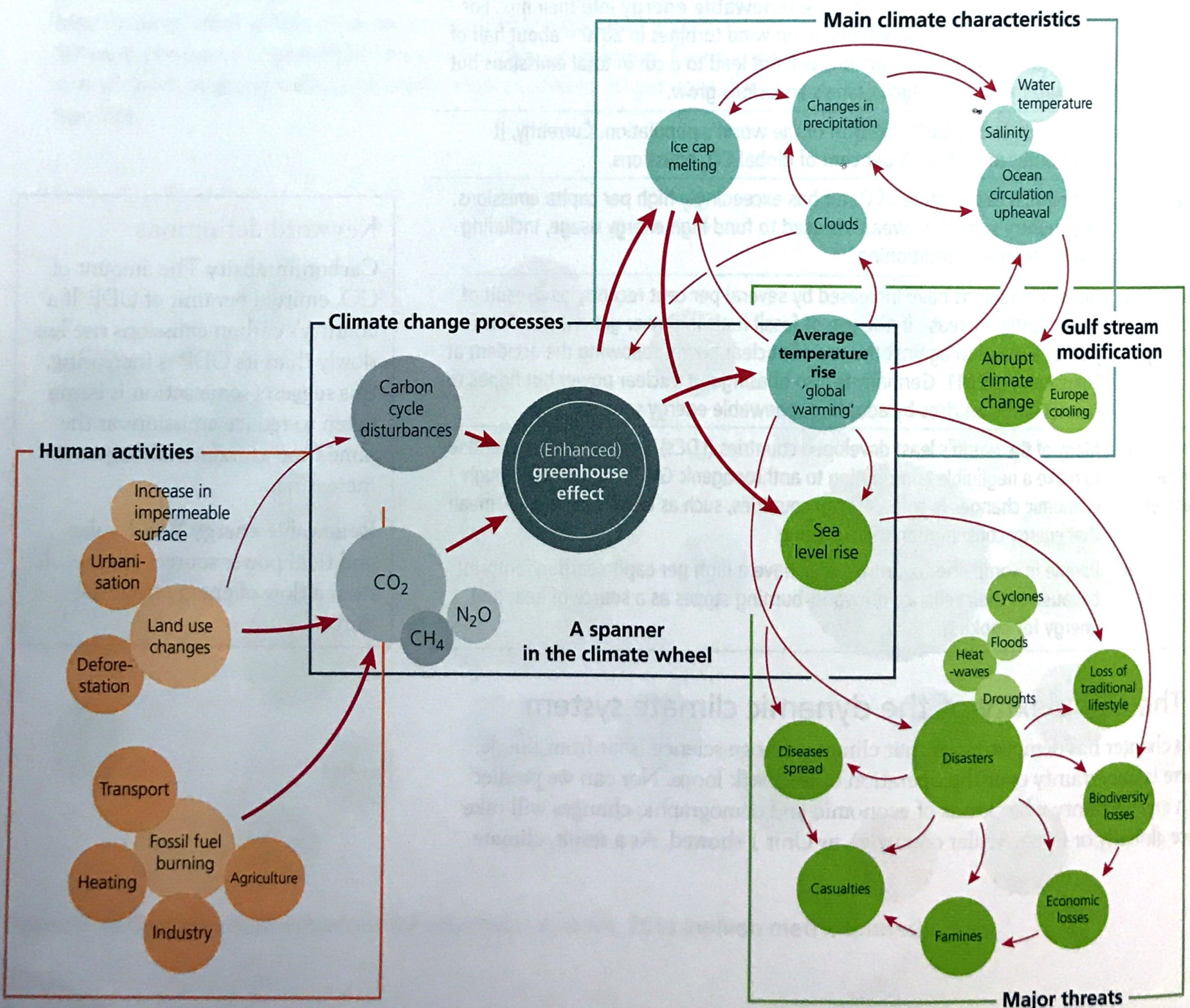


Figure 2.11 The complexity of global systems and feedback loops affecting climate change

Source: Cameron Dunn